

Rehabilitating Sleep

Commentary on Martin et al. Poor self-reported sleep quality predicts mortality within one year of inpatient post-acute rehabilitation among older adults. *SLEEP* 2011;34:1715-1721.

Marcia E. Braun, PhD¹; Nalaka S. Gooneratne, MD, MSc^{2,3}

¹Division of Sleep and Chronobiology, Unit for Experimental Psychiatry, Department of Psychiatry, University of Pennsylvania, Philadelphia, PA;

²Division of Geriatric Medicine, Department of Medicine, University of Pennsylvania, Philadelphia, PA; ³Center for Sleep and Circadian Neurobiology and Division of Sleep Medicine, School of Medicine, University of Pennsylvania, Philadelphia, PA

At the beginning of the 20th century, the average life expectancy was 47.3 years.¹ One hundred years later, in 2000, it had increased to 77.5 years.¹ This “plasticity of longevity” may continue into the foreseeable future: James Vaupel, Director of the Max Planck Institute for Demographic Research, has suggested that life expectancy will exceed 100 years for children born after 2000 in the U.S.² In addition to these demographic shifts, there have been significant declines in hospital length of stay, leading to higher rates of functional impairment at discharge. Thus, with increasing frequency, older adult patients will continue to have needs after a hospital admission that will necessitate post-acute rehabilitation, such as physical/occupational therapy or skilled nursing treatment (e.g., dressing changes or intravenous medication administration).

Post-acute rehabilitation care can be provided in many venues. These include skilled nursing facilities (SNF), home health care services (HHS), long-term care hospitals, and in-patient rehabilitation facilities (IRF).³ In 2010, SNFs represented the largest component of post-acute rehabilitation expenses, with 1.6 million Medicare fee-for-service beneficiaries using SNF services, the majority of which were for post-acute rehabilitation.³ IRFs were used by 360,000 Medicare beneficiaries.³ The length of stay for post-acute rehabilitation can range from an average of 13 days (IRF) up to 27 days (SNF), at which time patients may be discharged to home or converted to a long-term care status in the nursing facility.

Despite the fact that nearly two million older adults require facility-based post-acute rehabilitation care per year, relatively little work has been done to examine sleep in this environment. Since these patients are being cared for after an acute medical illness, they represent a fundamentally different patient population than that which is usually included in sleep research on institutionalized patients. In particular, they may have a large number of medical comorbidities—a factor associated with a greater risk of mortality⁴—yet retain a significant potential for recovery and return to a meaningful level of independence.

In the current issue of *SLEEP*, Martin and colleagues⁵ have expanded our understanding of post-acute rehabilitation care by reporting on the relationship between sleep quality and mortality. Notably, they found that poor sleep quality was independently related to a higher risk of mortality, even after controlling for other well-established risk factors, such as gender differences and comorbidity.⁵

Why do patients sleep so poorly in a post-acute rehabilitation setting? While a detailed review is beyond the scope of this commentary, several important points are worth highlighting. First, many of these patients may have an underlying sleep disorder. It is worth noting that the prevalence of sleep-related breathing disorders is 20% to 25% in older adults, nearly two to four times the prevalence in younger populations.⁶ Furthermore, patients requiring post-acute rehabilitation may have comorbid conditions such as congestive heart failure, atrial fibrillation, or diabetes, which are all associated with an even higher prevalence of sleep-related breathing disorders. Second, environmental factors, such as unfamiliar surroundings, excess noise or light, may also contribute to reduced sleep quality in the elderly. In this context, we most commonly think of nighttime interruptions (e.g., getting up to use the bathroom), and noise from other patients.⁷ However, health care personnel may often be at fault: Schnelle and colleagues noted that some of the most common causes of sleep disturbance in nursing home environments are loud noises from call bells, telephones, intercoms, and cleaning carts that are used during the night.⁸

How could poor sleep quality in the elderly undergoing post-acute rehabilitation relate to a higher risk of mortality, as observed by Martin and colleagues?⁵ There are several potential mechanisms through which disturbed sleep could increase mortality in the elderly. Reduced sleep quantity and quality has the potential to increase the risk of cardiovascular disease and stroke,⁹ fall-related injuries,¹⁰ and depression and other mood disorders.¹¹ Underlying sleep disorders, such as sleep-related breathing disorder with daytime sleepiness symptoms, may also increase mortality risk.¹² Interestingly, several studies have noted an attenuation of the association between sleep-related breathing disorders and mortality in older adults when including comorbid illnesses,^{13,14} or no evidence of increased mortality in older adults.¹⁵ One potential reason for this is the concept of competing risks: multiple diseases or disorders make it difficult to identify the independent effect of any one specific risk factor for mortality.¹⁶ Therefore, for older adults who have multiple competing risks for death, a single risk fac-

Submitted for publication October, 2011

Accepted for publication October, 2011

Address correspondence to: Nalaka S. Gooneratne, MD, MSc, Assistant Professor, Division of Geriatric Medicine, Center for Sleep and Circadian Neurobiology, University of Pennsylvania School of Medicine, 3615 Chestnut Street, Philadelphia, PA 19104; Tel: (215) 349 5938; Fax: (215) 573 8684; E-mail: ngoonera@mail.med.upenn.edu

tor may have an overall small effect on survival after taking into account other factors.

The study presented by Martin and colleagues⁵ begins to identify sleep-related factors that predict mortality for patients receiving care in a rehabilitation facility; however, several key questions remain. First, the prevalence of specific sleep disorders was not discussed in the current study and are possible mechanisms to be explored in future research. Second, future research should focus on one facility type—the current study included subjects from both a community-based and an in-patient facility. These are often different populations, and a prior paper from this group documented the differences between these two populations.¹⁷ The authors have addressed this by including in their multivariate models the covariates that demonstrated significant differences between groups, but it is possible that additional differences may exist. Third, objective or subjective assessment tools need to be developed that are robust enough to function in facility-based settings where older patients may have impaired cognitive function and recall of recent past events, such as their prior night's sleep, and where staff work in shifts (unlike the home environment where a single caregiver can serve as a proxy). Fourth, intervention trials are necessary to demonstrate clinical benefit associated with improved sleep quality. These trials can be challenging because acute medical needs can often disrupt carefully laid out sleep hygiene plans or other sleep promoting interventions. Furthermore, it is not uncommon for research studies in older adults to have negative findings because the effect size of many interventions may be small, in part due to the concept of competing risks noted earlier.¹⁶

In addition to these needed initiatives, there are two other important elements: dissemination and implementation. As researchers and health care providers with an interest in sleep medicine, most of us appreciate the importance of sufficient sleep quality and quantity. In the larger health care community, and especially in the acute care or post-acute care environments, this message may be drowned out because health care providers are often inundated with a bevy of signs, symptoms, test results, quality indicators, and other metrics of patient well-being. An inpatient nursing flow sheet, for example, can have over one hundred fields, ranging from dietary intake to fall risk, that need to be completed for each nursing shift for each of the registered nurse's five to seven patients. In SNFs, one registered nurse may be responsible for ten to twenty patients. Sleep quality, while often included on these nursing flow sheets, may be a neglected item. In this setting, how can sleep compete for prominence and gain recognition? The answer lies in research such as that conducted by Martin and colleagues,⁵ which draws attention to the independent effect sleep brings to risk of mortality. Indeed, as noted by the study authors, sleep may represent one of a few “modifiable” mortality risk factors in post-acute

rehabilitation patients. It is a finding worth sharing with our colleagues in the larger health care community.

CITATION

Braun ME; Gooneratne NS. Rehabilitating sleep. *SLEEP* 2011;34(12):1627-1628.

DISCLOSURE STATEMENT

Dr. Gooneratne has received a research grant from Takeda and an unrestricted educational grant from Respiroics. Dr. Braun has indicated no financial conflicts of interest.

REFERENCES

1. Shrestha LB. Life expectancy in the United States. In: CRS Report for Congress. Washington D.C.: Congressional Research Service, Library of Congress, 2006:30.
2. Vaupel JW. Biodemography of human ageing. *Nature* 2010;464:536-42.
3. Medicare Payment Advisory Commission (MedPAC). Medicare Payment Policy. In: Report to the Congress, March 2011. Washington, DC: Medicare Payment Advisory Commission, 2011:361.
4. Dew MA, Hoch CC, Buysse DJ, et al. Healthy older adults' sleep predicts all-cause mortality at 4 to 19 years of follow-up. *Psychosom Med* 2003;65:63-73.
5. Martin JL, Fiorentino L, Jouldjian S, Mitchell M, Josephson KR, Alessi CA. Poor self-reported sleep quality predicts mortality within one year of inpatient post-acute rehabilitation among older adults. *Sleep* 2011;34:1715-21.
6. Young T, Shahar E, Nieto FJ, et al. Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. *Arch Intern Med* 2002;162:893-900.
7. Redeker NS. Sleep in acute care settings: an integrative review. *J Nurs Scholarsh* 2000;32:31-8.
8. Schnelle JF, Cruise PA, Alessi CA, Ludlow K, al-Samarrai NR, Ouslander JG. Sleep hygiene in physically dependent nursing home residents: behavioral and environmental intervention implications. *Sleep* 1998;21:515-23.
9. Crowley K. Sleep and sleep disorders in older adults. *Neuropsychol Rev* 2011;21:41-53.
10. Grundstrom AC, Guse CE, Layde PM. Risk factors for falls and fall-related injuries in adults 85 years of age and older. *Arch Gerontol Geriatr* 2011; epub (ahead of print).
11. Buysse DJ. Insomnia, depression and aging. Assessing sleep and mood interactions in older adults. *Geriatrics* 2004;59:47-51; quiz 2.
12. Gooneratne NS, Richards KC, Joffe M, et al. Sleep disordered breathing with excessive daytime sleepiness is a risk factor for mortality in older adults. *Sleep* 2011;34:435-42.
13. Marti S, Sampol G, Munoz X, et al. Mortality in severe sleep apnoea/hypopnoea syndrome patients: impact of treatment. *Eur Respir J* 2002;20:1511-8.
14. Yaggi HK, Concato J, Kernan WN, Lichtman JH, Brass LM, Mohsenin V. Obstructive sleep apnea as a risk factor for stroke and death. *N Engl J Med* 2005;353:2034-41.
15. Punjabi NM, Caffo BS, Goodwin JL, et al. Sleep-disordered breathing and mortality: a prospective cohort study. *PLoS Med* 2009;6:e1000132.
16. Welch HG, Albertsen PC, Nease RF, Bubolz TA, Wasson JH. Estimating treatment benefits for the elderly: the effect of competing risks. *Ann Intern Med* 1996;124:577-84.
17. Alessi CA, Martin JL, Webber AP, et al. More daytime sleeping predicts less functional recovery among older people undergoing inpatient post-acute rehabilitation. *Sleep* 2008;31:1291-300.